SCIENCE

10 July 1970

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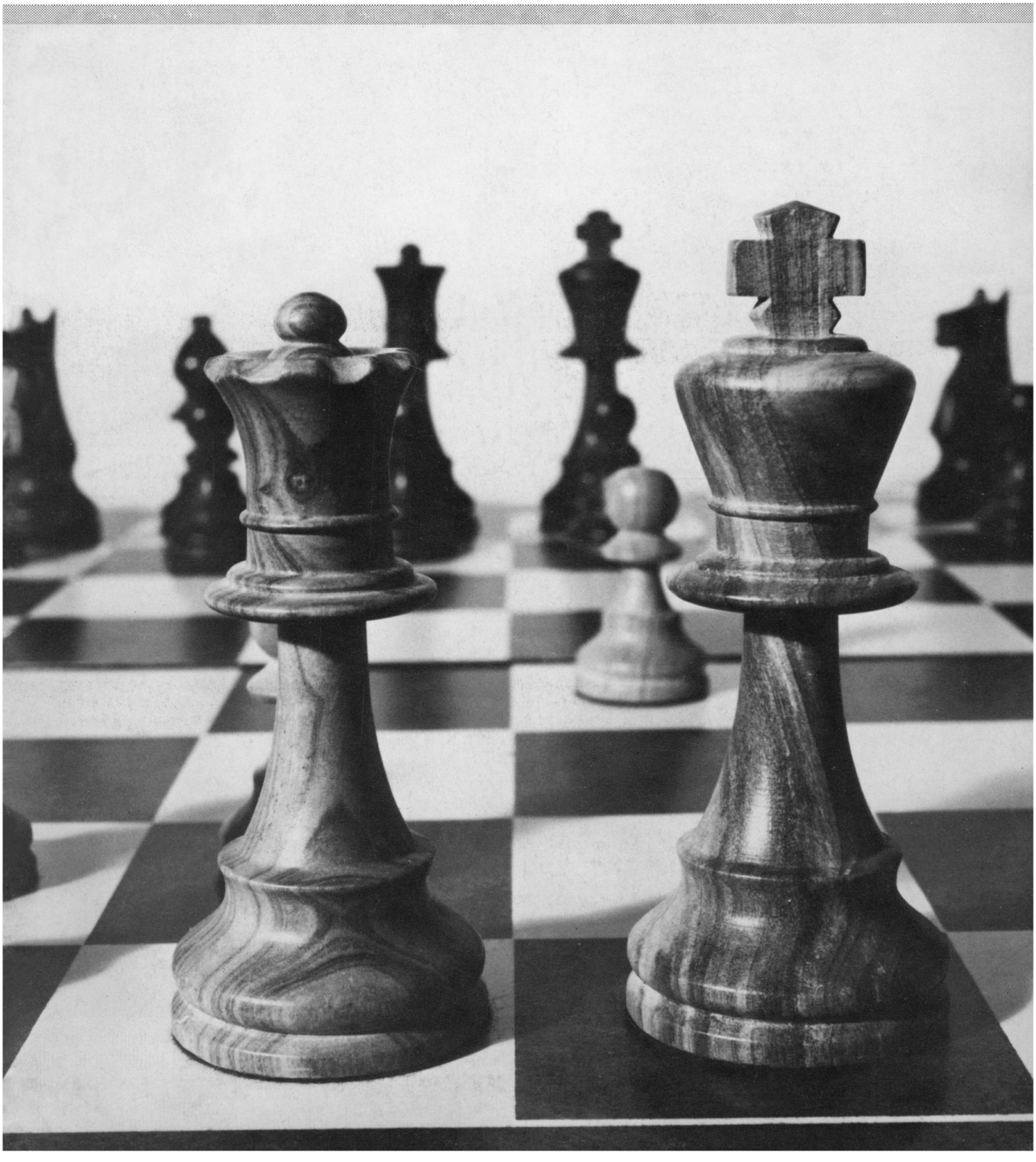
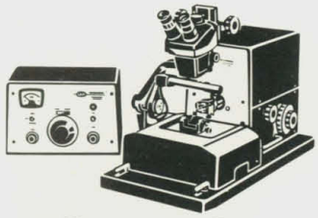
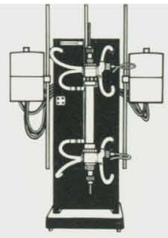
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

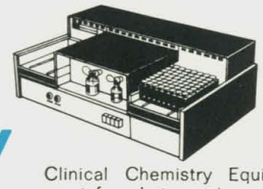




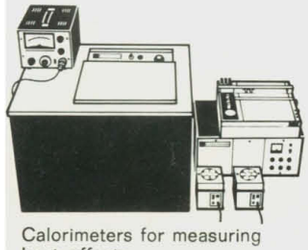
Ultramicrotomy Equipment for electron microscopy.



Chemical Laboratory Equipment for Research, Industry and Medicine.



Clinical Chemistry Equipment for photometric analysis.



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SCIENCE

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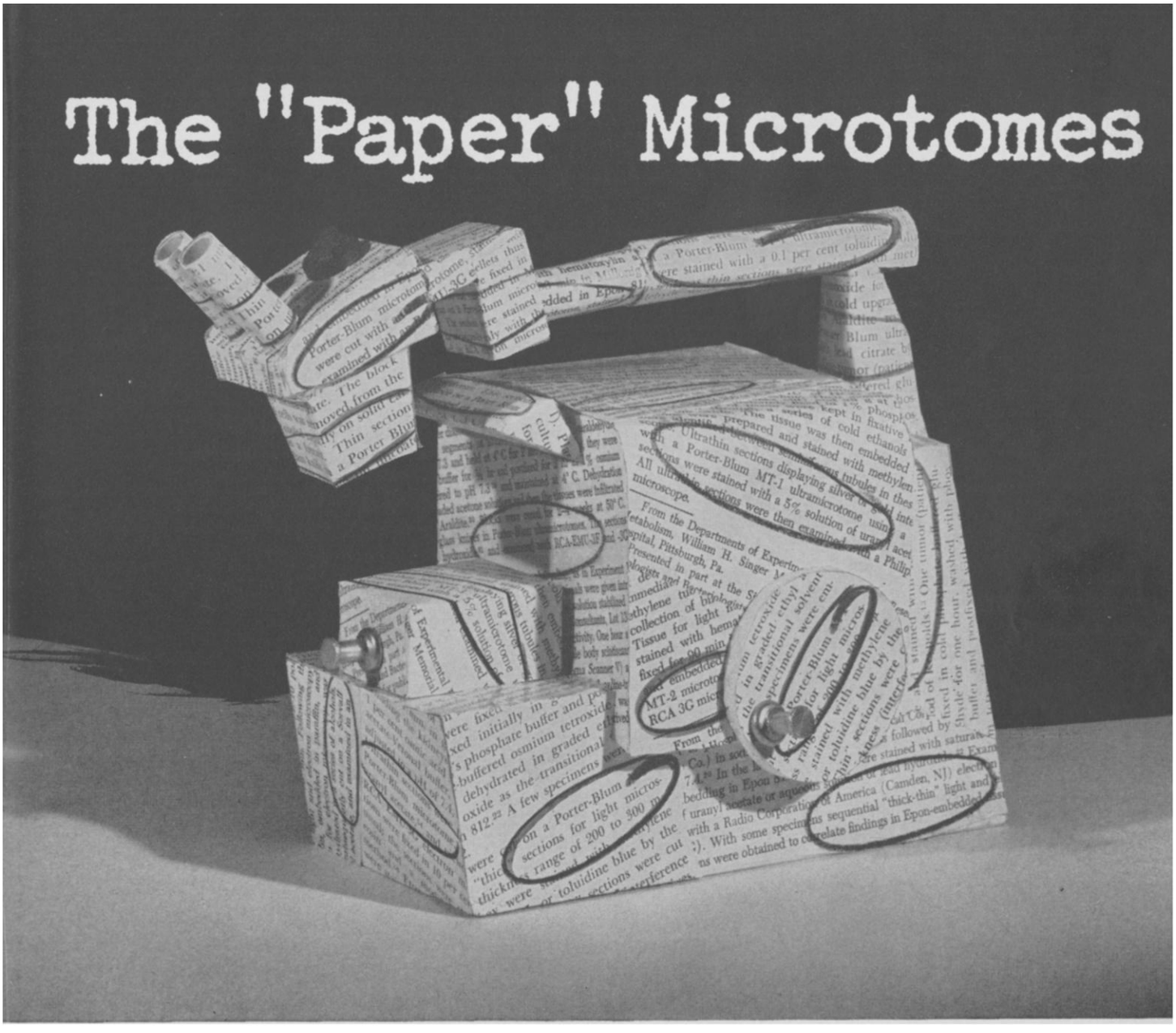
COVER

Although the invention of chess has been ascribed to various peoples, it probably originated in India about the 7th century. In the future it may be possible to develop computer programs for chess play. For a model of problem-solving in chess, see page 209. [Gary Laurish Photography, Washington, D.C.]

The "Paper" Microtomes



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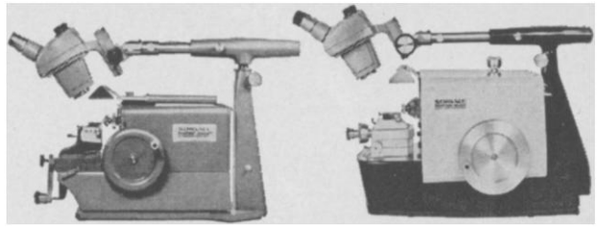

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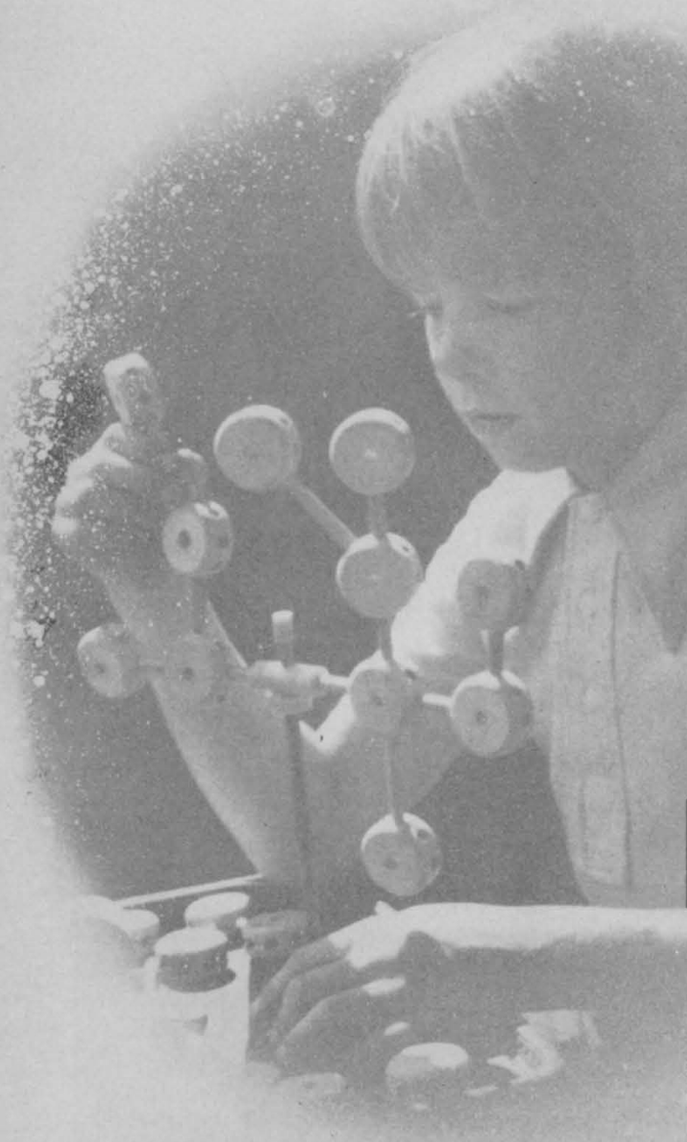

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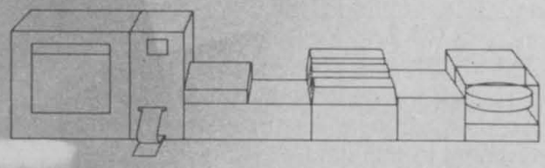

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Concepts from Union Carbide:

Cryogenic freezing of red blood cells

Probably no single problem has received more attention from cryobiologists than the preservation of the human red cell. And with good reason. Procedures that extend the supply of erythrocytes for transfusion have meaning in terms of human lives.

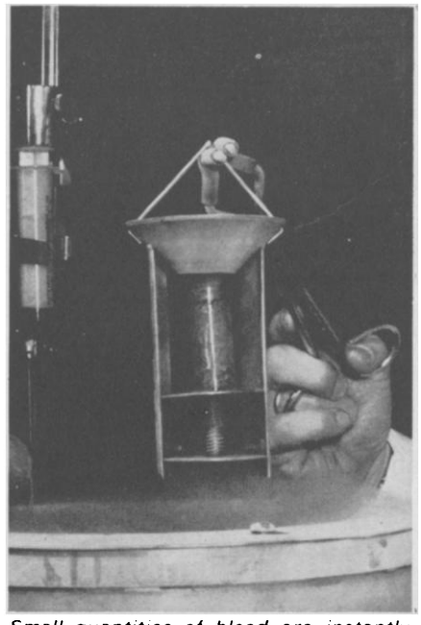
The prospect of a frozen blood reserve has been a matter of intensive interest to the blood banking agencies for the past twenty years; some have played a major role in the scientific attack on the problem. It has not been easy. It was observed in 1941 that red cells (suitably protected with additive substances) could survive the drastic environmental changes induced by freezing. Since then, processes have been sought for the preservation of blood in the frozen state that would provide a useful and acceptable product for transfusion. As evidenced over the past decade by the successful transfusion of thousands of units of blood preserved in the frozen state, that goal seems to have been reached.

The current limitation of twenty-one to twenty-eight days for blood preserved by conventional methods in the liquid state has often taxed the resources of the organizations that undertake to provide our communities with supplies of this indispensable agent. The relatively short shelf life of the cellular components of blood adds to the problem of coordinating supply with demand. The less common blood types sometimes are difficult to procure, but even the more common types may vary in supply at any given time.

Red cell wastage is an inevitable consequence of the dating period necessarily imposed on blood stored at 4°C. A primary objective of agencies interested in preserving blood at low temperatures is to prevent this wastage. Another, of course, is to assure adequate reserves of all types of blood at all times for each community. Conceivably then, as frozen blood banks become established in various parts of the country, an integrated and computerized inventory system could be developed that would result in an effective national reserve.

Several practical approaches to the preservation of blood at low temperatures have evolved. All have some elements in common. A solution of additives, often called cryoprotective agents—glycerol is the outstanding example—is combined with the red cells from which most of the plasma and much of the other cellular components of blood (leukocytes and thrombocytes) have been removed. This is done in special containers in which the erythrocytes are cooled and placed in long-term storage. When needed, the erythrocytes are withdrawn from storage, warmed, and subjected to a washing procedure to remove the protective agent before transfusion.

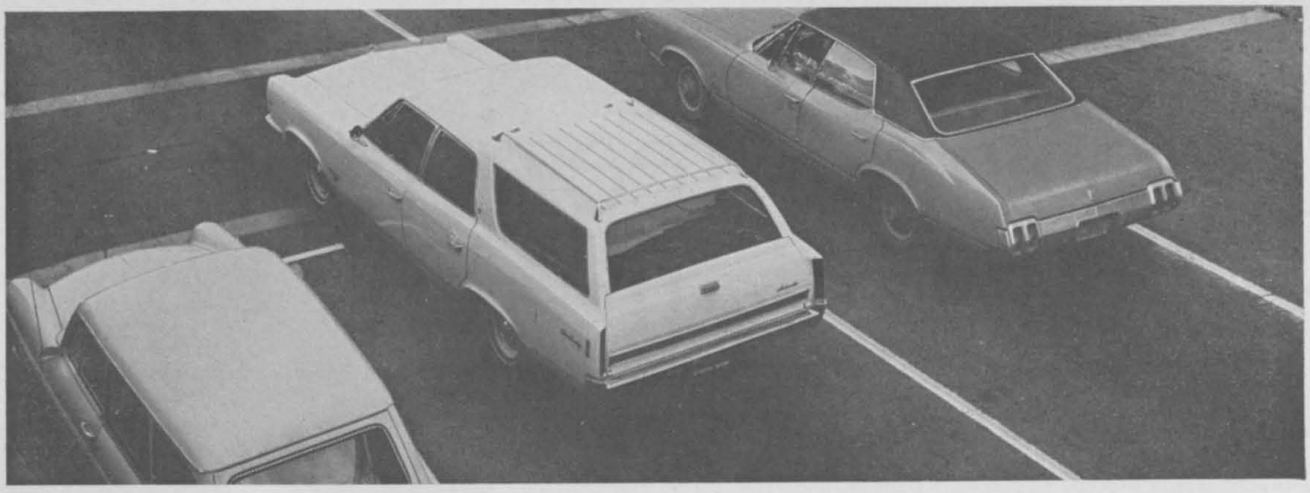
The heart of a frozen blood reserve is the storage facility. Storage equipment is of two general types: cryogenic and noncryogenic. The latter provides temperatures down to about −85°C and depends on electric power. The cryogenic equipment is independent of a power source and provides lower storage temperatures—down to −196°C—with liquid nitrogen, the most commonly used refrigerant. Associated with such storage equipment are cryogenic shipping units that permit transport of blood in the frozen state without danger of a destructive rise in temperature that might render the blood cells unfit for transfusion.



Small quantities of blood are instantly frozen for long-term storage in the droplet freezer. A mechanically vibrated syringe releases droplets into a revolving drum of liquid nitrogen. The frozen droplets are collected in the base. Thousands of droplets can be collected from each sample for use as reference specimens.

The banking of frozen blood with longer shelf life should considerably enhance the ability of the blood supply agencies to meet demand and might influence current procurement practices. The use of cryogenic storage equipment would provide a margin of safety for autologous blood banking in which individuals of rare blood type would establish a reserve of their own blood in anticipation of later need. Probably most important in terms of medical need, the availability of banks of frozen red cells would seem likely to lead to the development of banks of the other cellular components of blood. With current liquid state storage procedures, platelets and leukocytes—far less stable than the red cell—are without transfusion value within about three days or less after donation. At present, the only prospect for establishing a large-scale reserve of these invaluable components is to preserve them in the frozen state. Although low temperature preservation procedures for these cells are not technically as far advanced as for the red cell, several blood laboratories are fully aware of the need and are attacking the problem vigorously.

The refrigerator shown here stores red blood cells for transfusions. No other cryogenic refrigerator provides as much storage capacity in as little space as the LINDE LR-1000.



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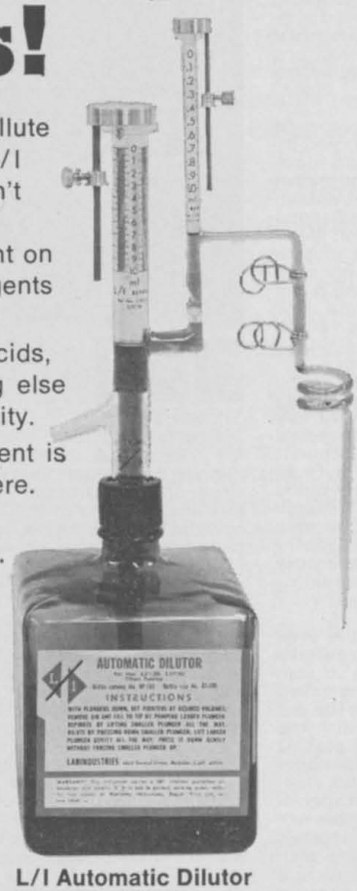

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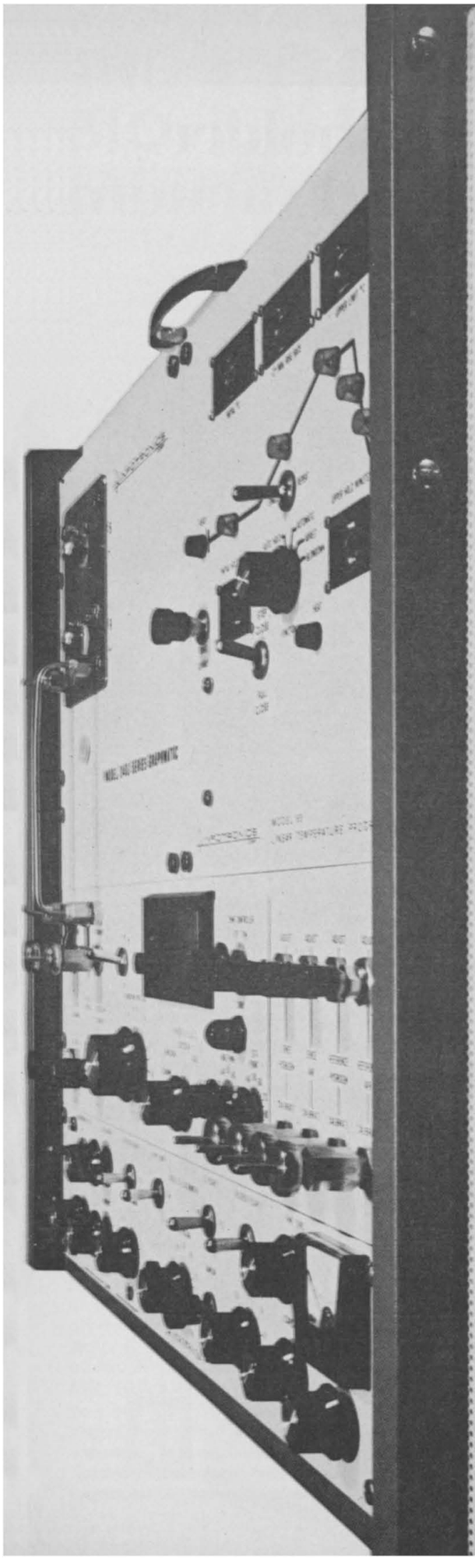

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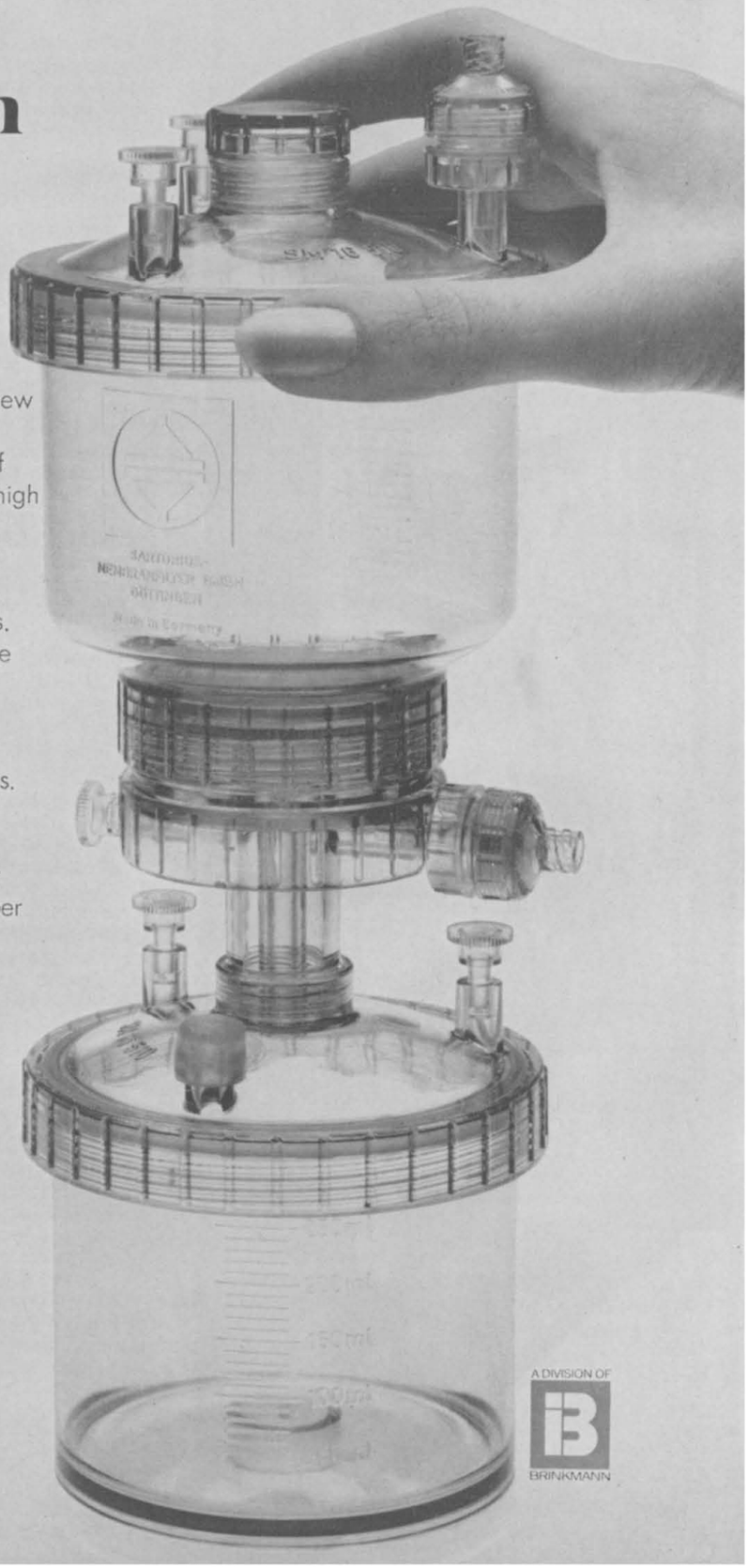

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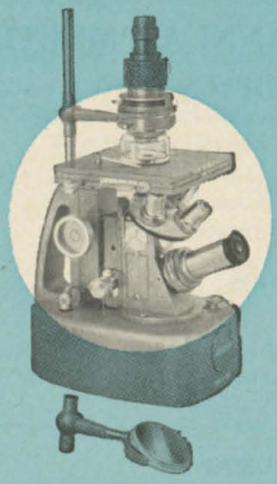
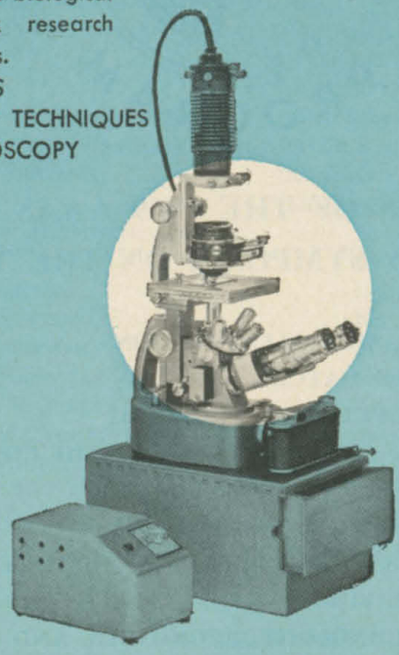


MODEL MIC



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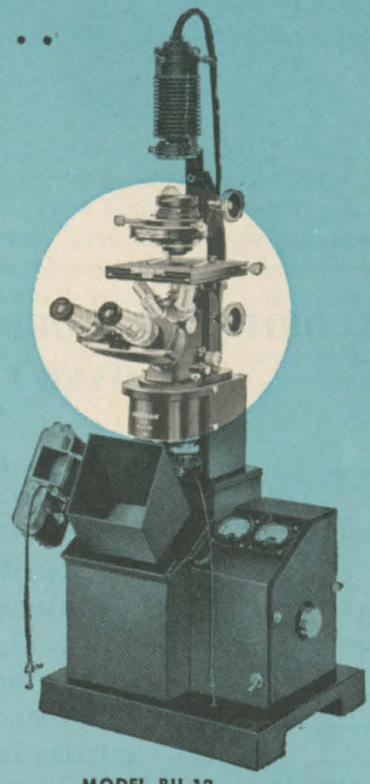

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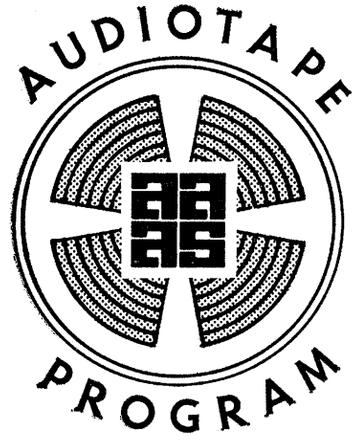

AUDIOTAPE RECORDINGS OF THE 1969 AAAS ANNUAL MEETING OVER FIFTY SYMPOSIA ON THE TOPICS

HUNGER, FOOD, AND MALNUTRITION
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FAMILY AND POPULATION PROBLEMS
THE EARTH, THE SOLAR SYSTEM, AND THE COSMOS
HEALTH, DISEASE, AND BEHAVIOR
SOCIAL AND POLITICAL INTERACTION
ETHICS, MORALS, PHILOSOPHY, AND HISTORY
LIFE AND THE LIVING EARTH
AFFAIRS OF TECHNOLOGY, ECONOMICS, AND BUSINESS
EDUCATION, LEARNING, AND COMMUNICATIONS
INTERACTION WITH THE ARTS

In the 20 February 1970 issue of *Science* (pages 1159–1161) we announced the availability on audiotape of the proceedings of selected sessions of the Boston 1969 Meeting. We are now happy to announce the addition of two more symposia—**The Identity and Dignity of Man** and **Science and Music.**

11/69. **The Identity and Dignity of Man: A Scientific and Theological Dialogue on Issues Emerging from Behavioral, Surgical, and Genetic Interventions** (Multi-session symposium, arranged by GEORGE P. FULTON and PRESTON N. WILLIAMS—compiled into eight parts of broadcast-quality recordings)

11/69-I. **Control of Population and Regulation of Behavior**
Biological Aspects of Aggression and Violence (HUDSON HOAGLAND)
Population and the Dignity of Man (ROGER L. SHINN)
Panel Discussion: *Population and Behavior* (Chairman: CHARLES E. CURRAN; Panelists: HUDSON HOAGLAND, ROGER L. SHINN, ERNST MAYR, FRANK ERVIN, and G. EVELYN HUTCHINSON)

11/69-II. Workshop A: **Problems of Population Control** (Chairman: IRWIN SANDERS; Co-Chairman: PAUL DEATS)

11/69-III. Workshop B: **Regulation of Behavior** (Chairman: JOSEPH SPEISMAN; Co-Chairman: JOSEPH FLETCHER)

11/69-IV. **Extension of Life Through Organ Replacement**
Social Investment and Patient Welfare in Organ Transplanation (FRANCIS D. MOORE)
Organ Transplants as Related to Fully Human Living and Dying (L. HAROLD DEWOLF)
Panel Discussion: *Extension of Life* (Chairman: PAUL RAMSEY; Panelists: FRANCIS D. MOORE, L. HAROLD DEWOLF, ROBERT S. SCHWARTZ, and HENRY K. BEECHER)

11/69-V. Workshop C: **Problems with Organ Replace-**

ment (Chairman: JOHN A. MANNICK; Co-Chairman: RALPH B. POTTER)

11/69-VI. **Improvement of Quality of Life Through Genetic Manipulation**
Preventive and Curative Approaches to Genetic Problems in Man (BERNARD D. DAVIS)
Genetic Engineering and the Normative View of the Human (JAMES M. GUSTAFSON)
Panel Discussion: *Problems with Genetic Manipulation* (Chairman: HANS JONAS; Panelists: BERNARD D. DAVIS, JAMES M. GUSTAFSON, ISAAC ASIMOV, JOHN R. PLATT, and ANTONIE BLACKLER)

11/69-VII. Workshop D: **Problems with Genetic Manipulation** (Chairman: DOROTHEA RAACKE; Co-Chairman: PRESTON N. WILLIAMS)

11/69-VIII. **Summary of Conference** (Chairman: ISAAC ASIMOV)
Reviews by workshop chairmen:
Population (IRWIN T. SANDERS)
Behavior (JOSEPH C. SPEISMAN)
Transplants (JOHN A. MANNICK)
Genetics (I. DOROTHEA RAACKE)
Workshops Summary (MELVIN M. KETCHEL)
Remarks (WALTER G. MUELDER)

55/69. **Science and Music (A Concert/Symposium)** (Single-session symposium, arranged by MILTON B. BABBITT and ALAN A. SMITH; Chairman: DAVID EPSTEIN)
Speakers: DAVID EPSTEIN, VLADIMIR USSACHEVSKY, and JOHN HEISS
Concert Selections:
USSACHEVSKY: *Of Wood and Brass*
DAVIDOVSKY: *Synchronism #2 for Four Instruments and Tape*
BABBITT: *Ensembles for Synthesizer*

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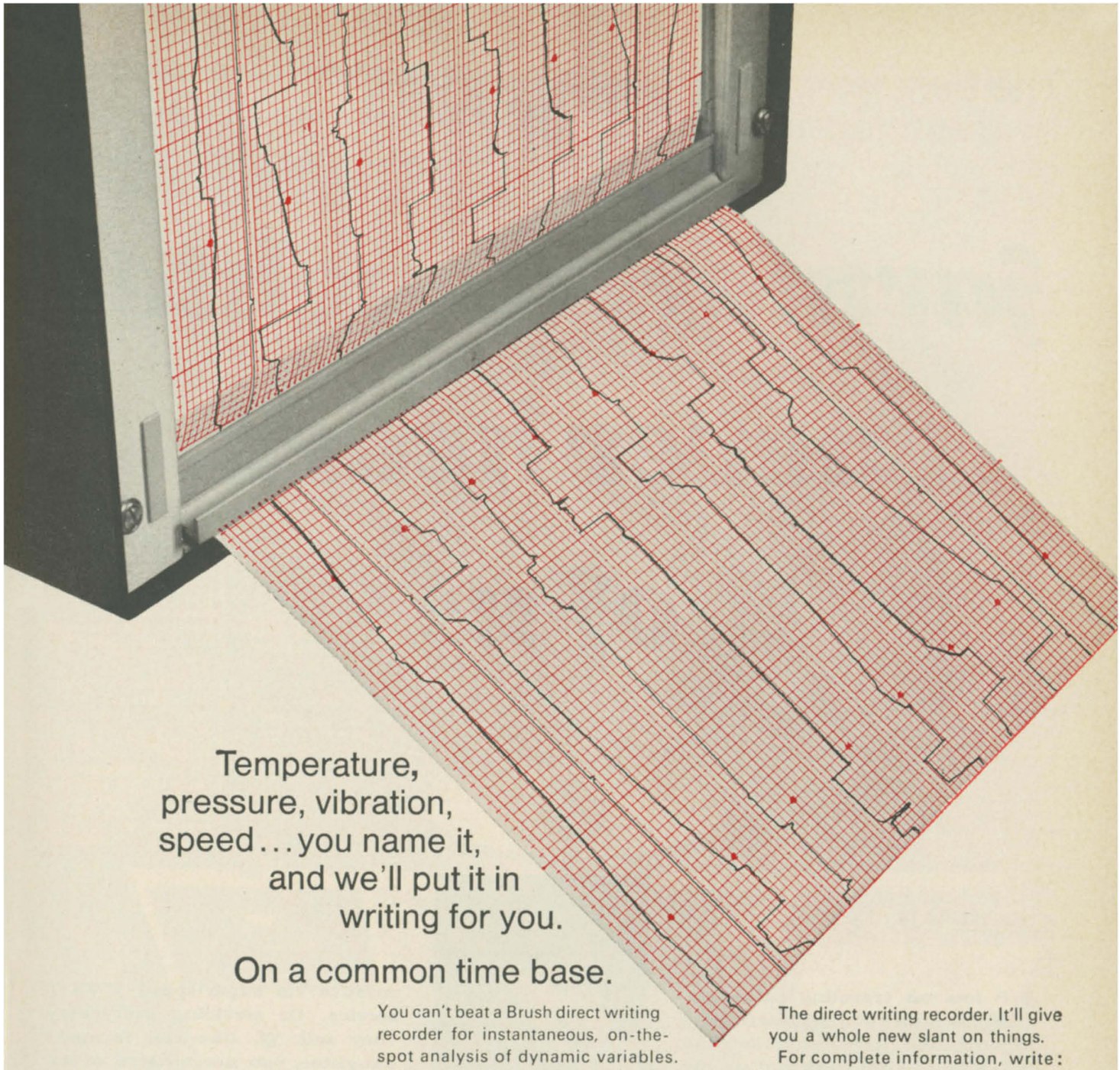

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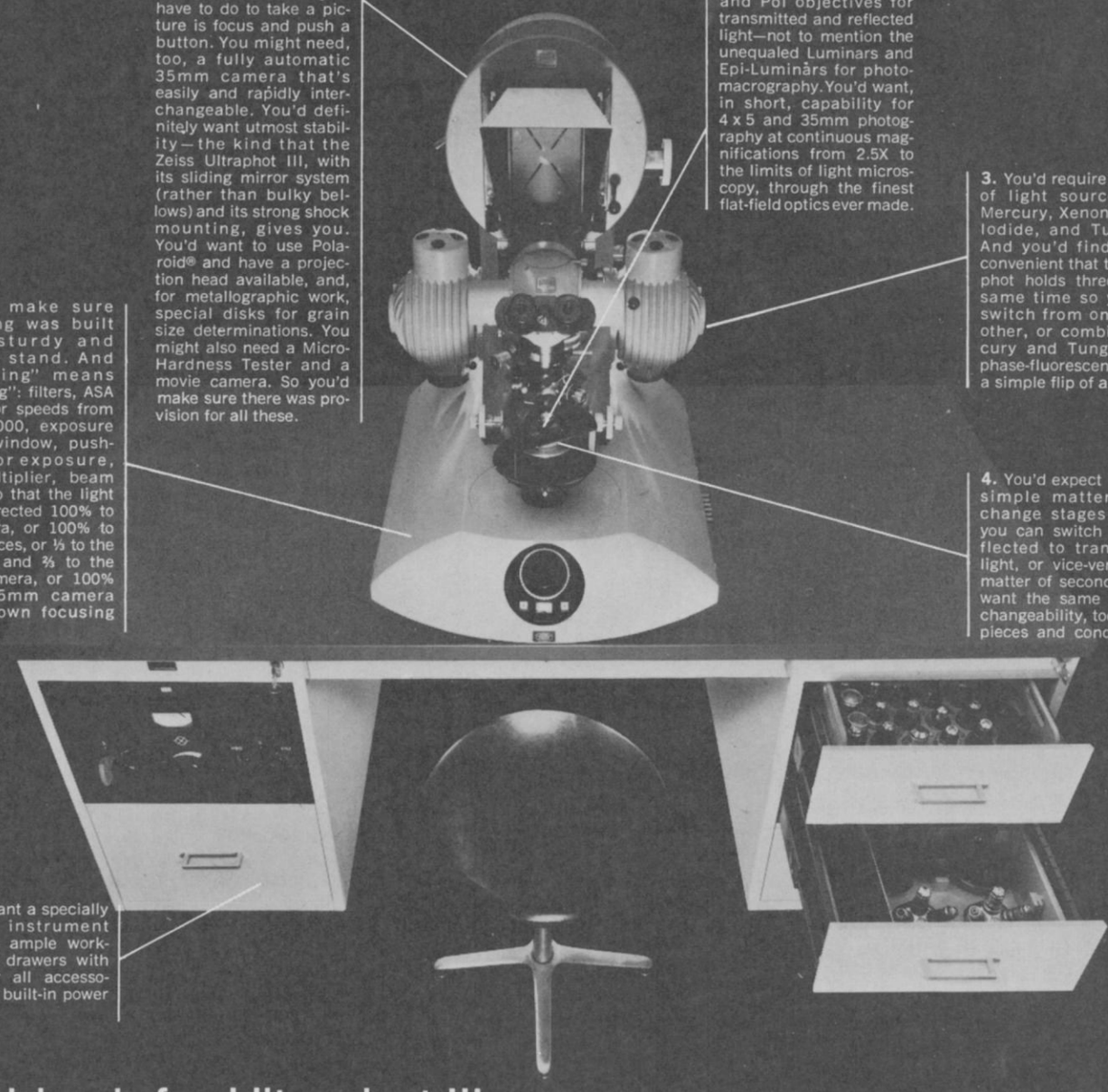

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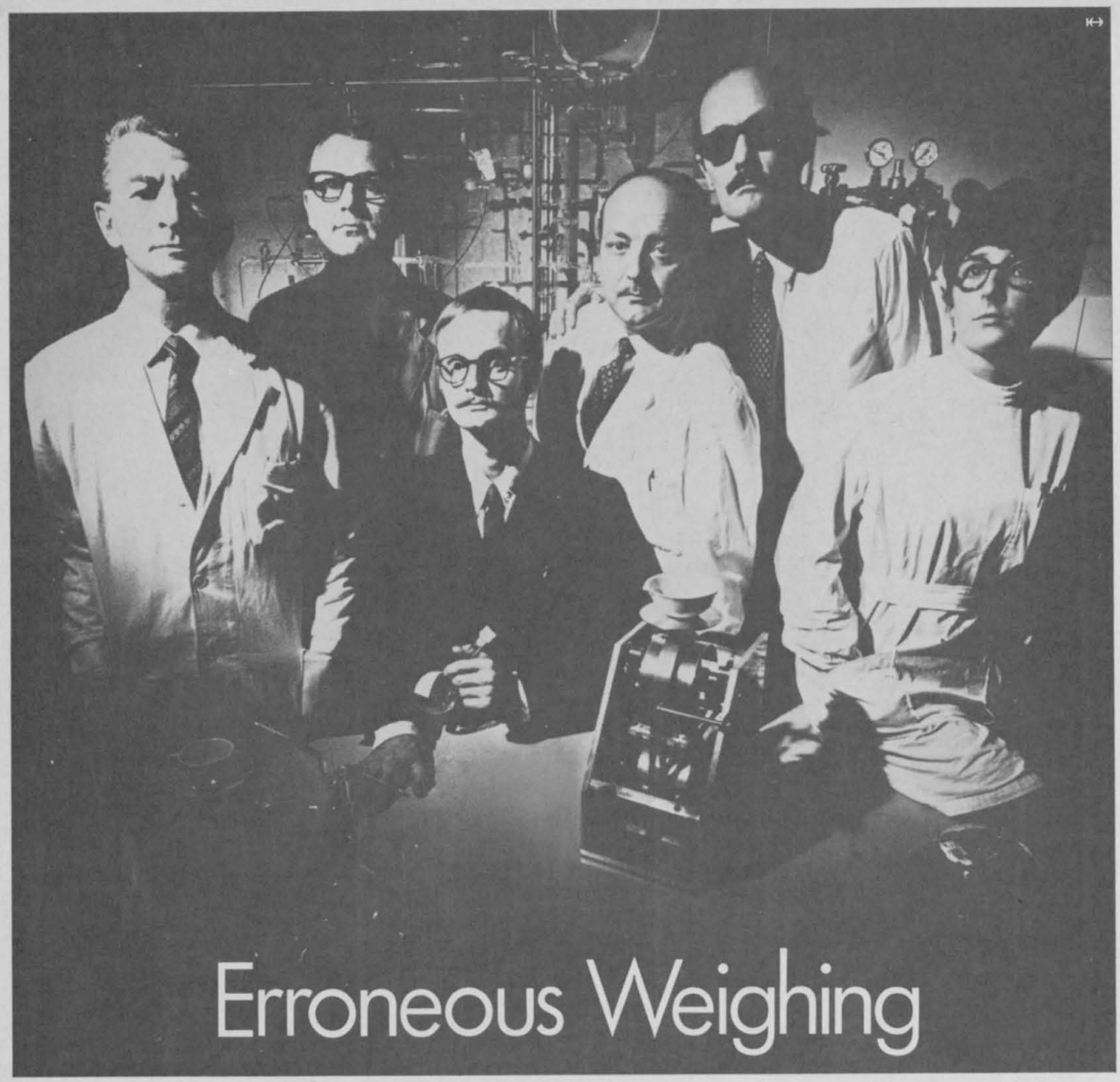

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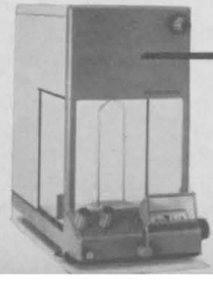

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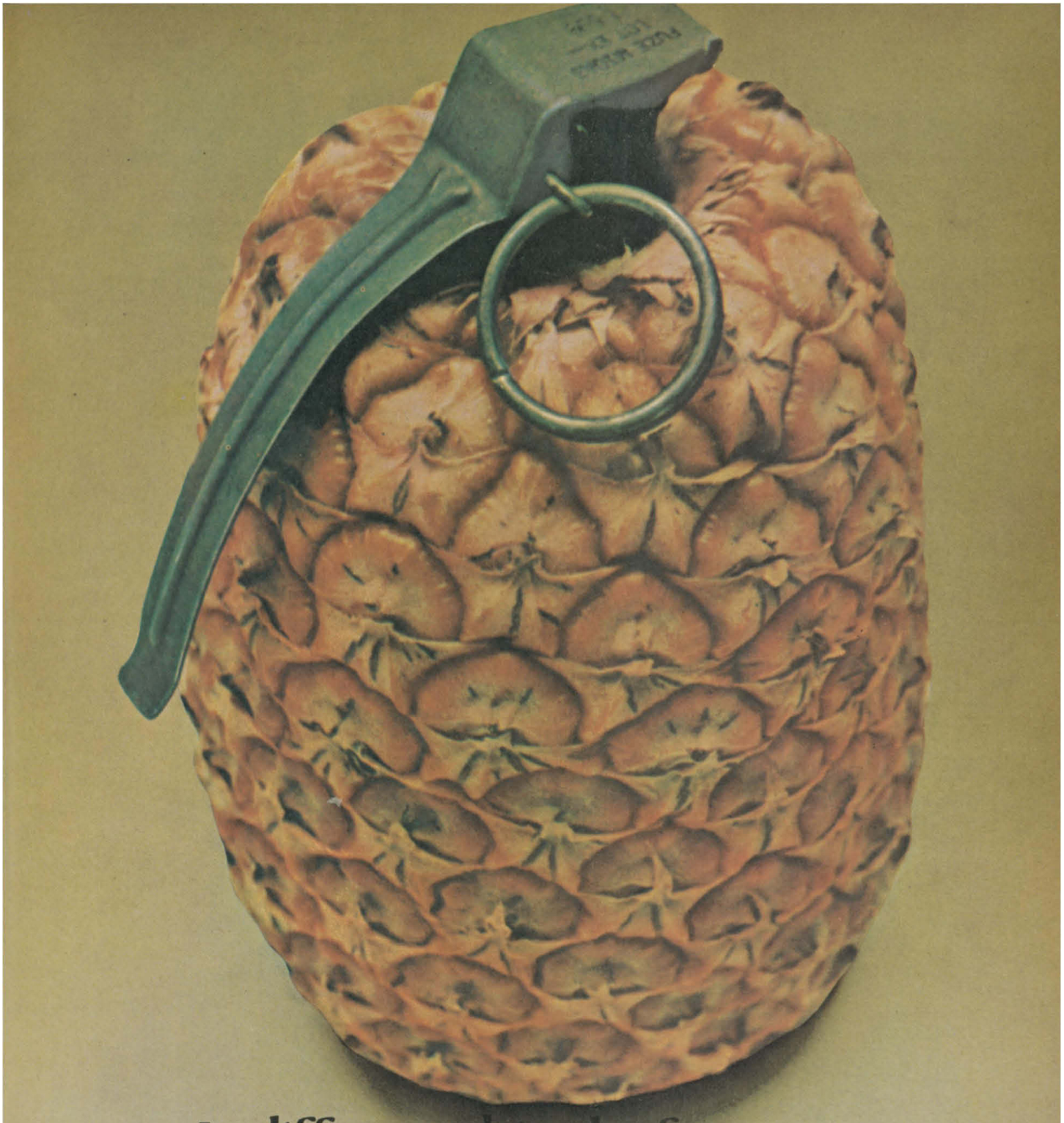

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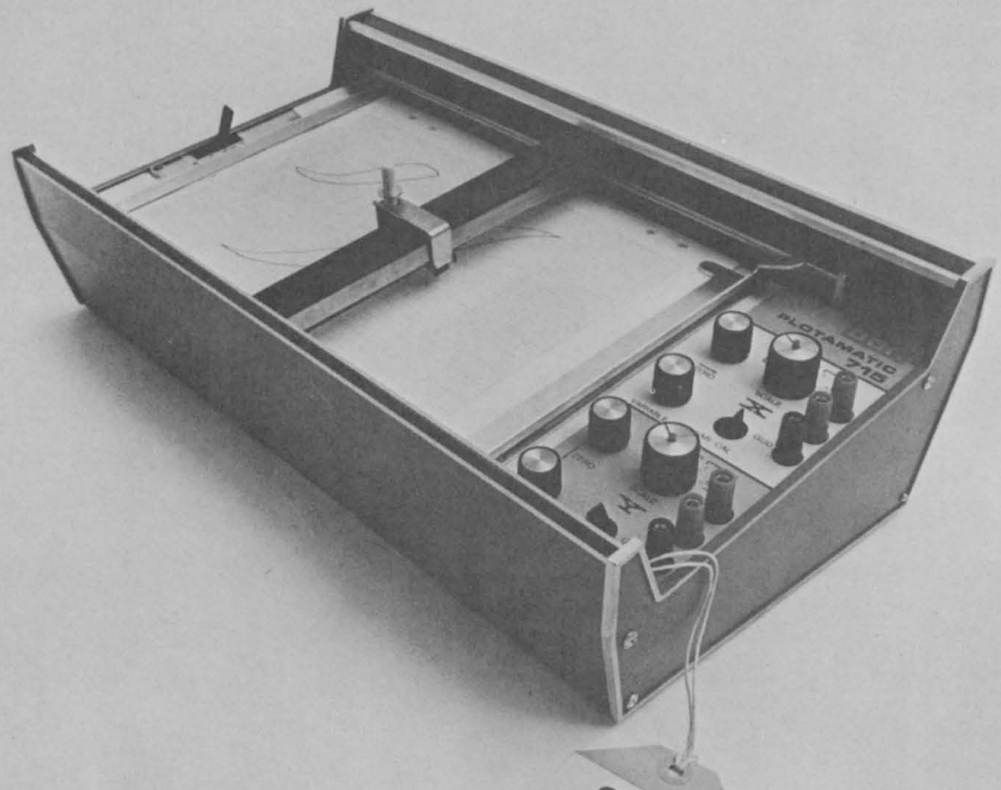

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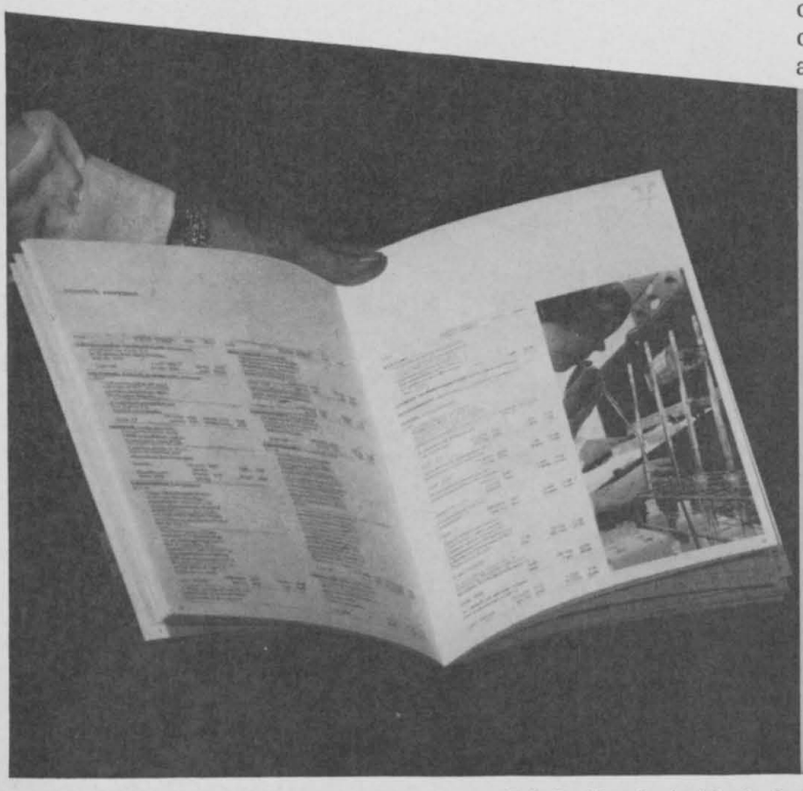

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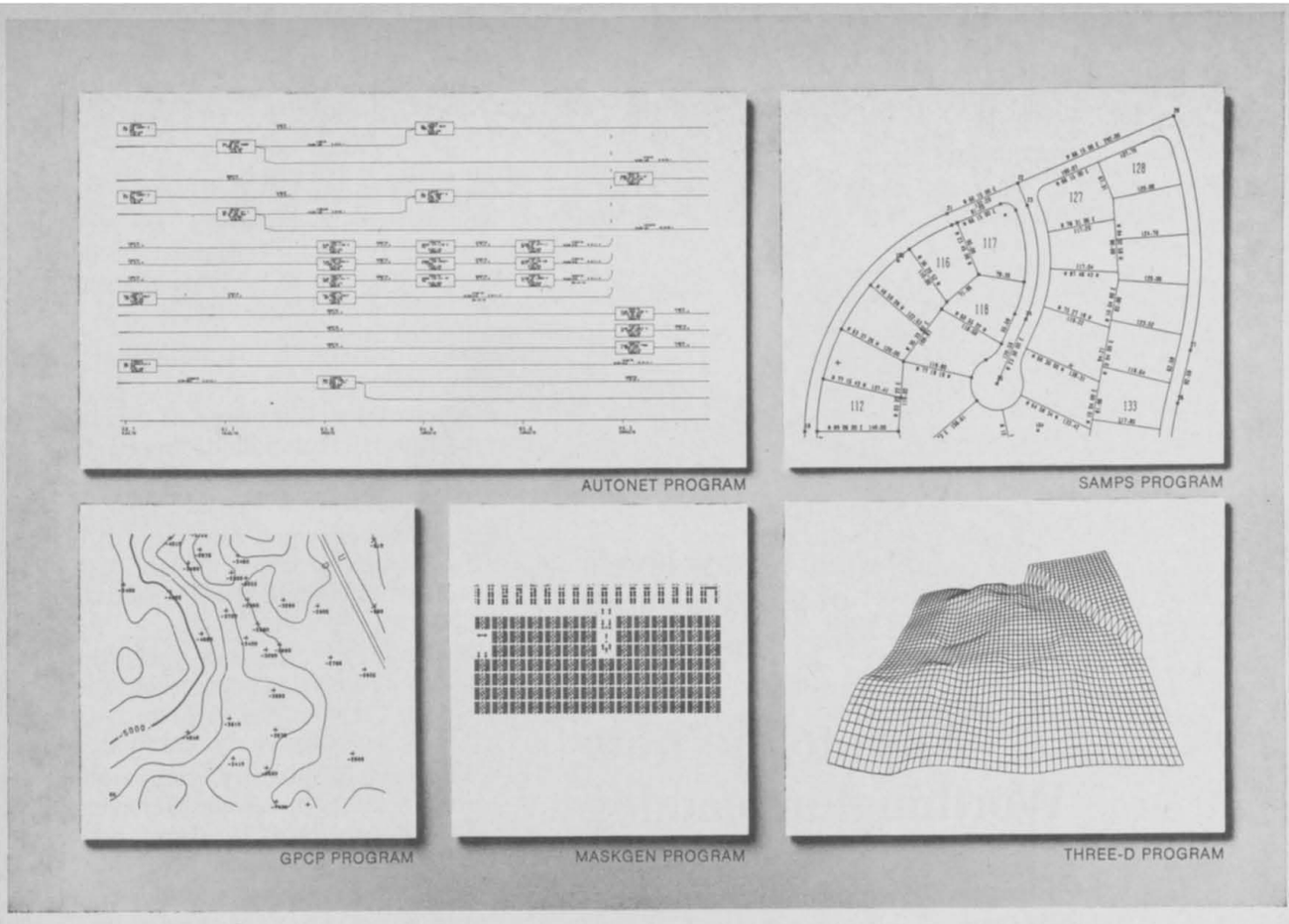

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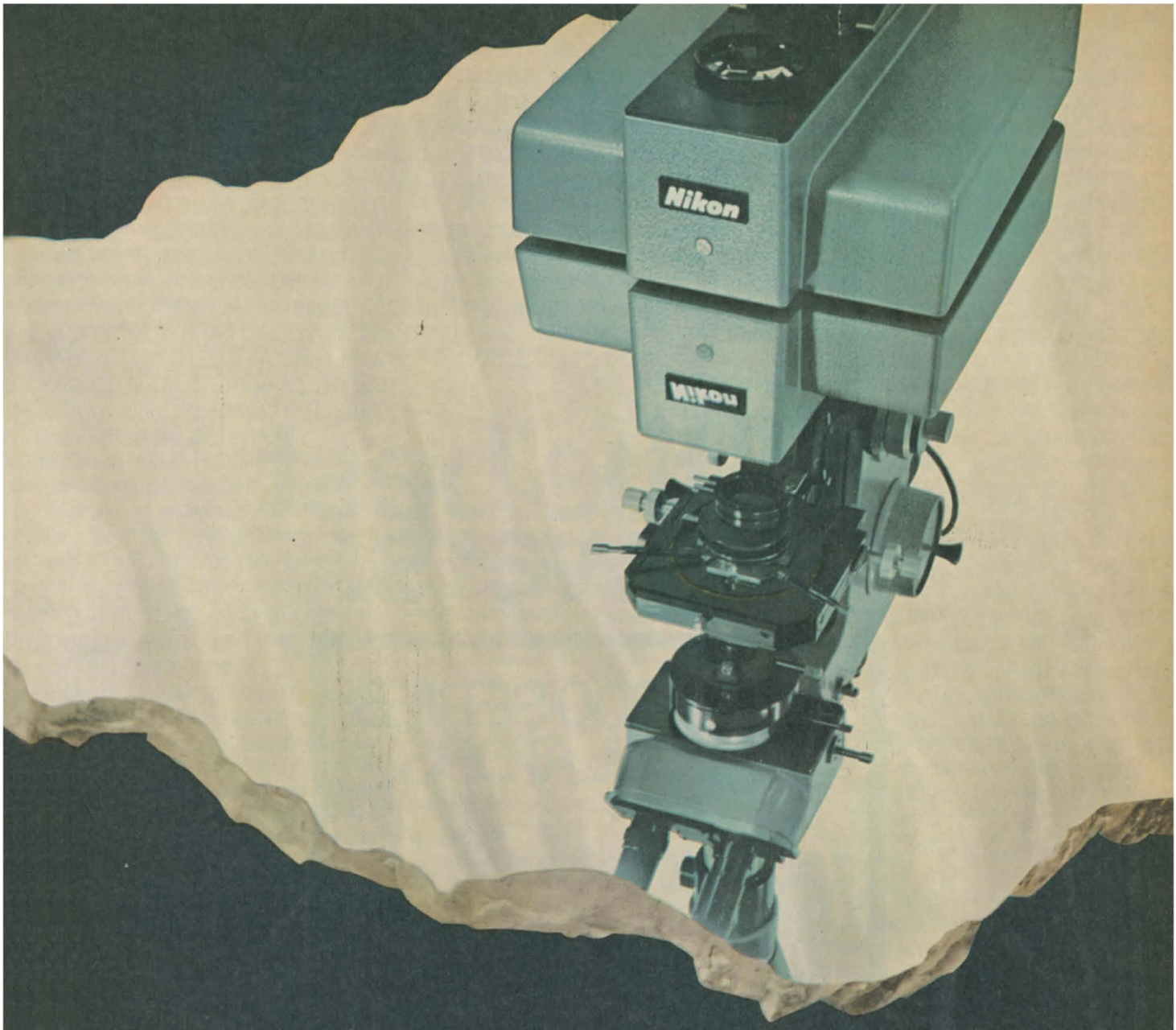

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New Nikon Apophot Research Microscope

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Still the best answers.

It has been my experience that the meetings held on college and university campuses could not have been finer! To construct a "scientific center" of the sort Hoffman suggests, whether in the geographical heart of the country or elsewhere, would seem a tragic error in the direction of more and greater bureaucracy and the further sterilization of science—all at vast public expense. Moreover, we would lose the advantage of visiting many different educational centers where we taste the flavor of discovery and meet the men who are "discovering"—and who enjoy greeting us on their own home grounds.

GEORGE AVERY
Brooklyn Botanic Garden,
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Mistaken Identity

In my review of Günther Buttmann's biography of John Herschel (8 May, p. 731) I wrote "three out of four people who have heard of 'Herschel' at all will assume that you have confused the name of his father, William Herschel, and the fourth is himself not clear about the difference."

Your editor kindly added to my review two pictures of "the 40-foot telescope in John Herschel's garden at Slough." It is, of course, *William* Herschel's famous telescope, sitting in the garden after his death.

Thus we see that, contrary to the oft-repeated maxim, historical knowledge *can* be used for prediction. In experienced hands it is as accurate as meteorology—maybe more so.

WALTER F. CANNON
Division of Physical Sciences,
Smithsonian Institution,
Washington, D.C. 20560

Weather Program: Plea for Candor

"Weather services: Working toward worldwide forecasts" (17 Apr., p. 352) is accurate, but the omissions are probably more important than the report. There is no indication of the budgets for this international cooperation and how they are shared and managed. The World Meteorological Organization has a budget of slightly over $3 million per year, most of which pays for the staff in Geneva and overhead. Therefore, these international programs are large-

ly funded by national governments. It is very difficult to find out the total program cost and how these costs are shared. Indeed, it is very difficult to find out what the world expenditures and allocations are in general. My personal estimate is that the United States is paying a very large portion of the total investment; that separate British, French, and Russian weather satellite programs are very wasteful. It is also difficult to get any cost information from the WMO.

The time is rapidly approaching when people will ask rather pointed questions about the costs and effectiveness of the weather program. I understand your reporter tried and failed to secure this type of information.

ARTHUR W. BARBER
Institute for Politics and Planning, Suite 500, 1411 K Street, NW, Washington, D.C. 20005

Child Studies

In Rheingold's and Eckerman's "The infant separates himself from his mother" (3 Apr., p. 78), I found it frankly perplexing that, in an article on the subject of mother-child separation, there was no mention of Margaret Mahler. Mahler's original and outstanding contributions to this area of study are widely known and accepted. Most of her scientific career has been devoted to this "class of behavior which has not often been the subject of formal study." Rheingold demonstrates her awareness of the psychoanalytic literature and does make use of it, unfortunately, not to any degree of completeness. . . .

L. J. BYERLY
Department of Child Psychiatry, Temple University School of Medicine, Philadelphia, Pennsylvania 19122

We appreciate having Mahler's contribution to the topic brought to our attention. Her discussion is, however, discursive, wanting in quantitative data, and often oriented toward pathology; our statement that the infant's separation from his mother "With only a few exceptions . . . has seldom been the primary subject of study" still stands.

HARRIET L. RHEINGOLD
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10 July 1970, Volume 169, Number 3941

SCIENCE

New Policy for the Government-University Partnership

For the first time since the period 1945–47 the United States is in the midst of shaping a new science policy. The old government-university partnership had already lost its basic rationale even before the events of early May. The campuses are now centers of questioning of many aspects of the connection between university and government at the same time that the Administration is checking budgetary support, applying political tests to appointments for technical positions, and dismantling the organization for science within the government. The two parts of the government-university partnership are thus moving away from one another so fast that even to talk of science policy in the present circumstances is to look toward the creation of a new partnership, not a revival of the old one.

A listing of the changes now going on which will shape the new science policy might include:

1) The Department of Defense has lost its ability to justify support for basic research and also to attract the services of many scientists. Yet the problems of military research are now unprecedentedly difficult because of the serious implications of the diplomatic and military policies of the Administration. If the scientists knowledgeable in military research, who provide one of the groups with the best chance to change the course of events with competent criticism, lose touch with the Department of Defense completely, an unparalleled disaster could ensue. Yet a reordering of the relation of the scientific community to the Department of Defense cannot be postponed.

2) The scientific community must pay much more attention to environmental problems. In attempting to alter priorities in favor of the environment, architects of the new science policy must bear in mind the need for disciplines long relatively neglected and remember the presence in the government of old and stable research traditions which have been considering the environment for more than a century.

3) The space program must find a role for itself with predominantly scientific objectives and a steady state of funding.

4) The social sciences must receive greater emphasis both because they have demonstrated increased effectiveness in the last quarter century and because the demand for their application has increased. The question must be faced of how to mesh them with sensitive social problems and also with projects heretofore considered the preserve of the natural sciences without destroying their integrity.

5) The justification of federal support for research in the universities must emphasize the goal of building healthy institutions in the national interest. The support must extend to the humanities and to those parts of the social and natural sciences which contribute strongly to the institutions but whose connection with practical applications is indirect.

6) Support for education must contemplate a national research program with a radically different mix of disciplines from that recently prevailing.

A science policy which takes into account the changing realities of 1970 cannot confine itself to a single problem, a single agency, or a single mechanism for reorganization. The science agencies, the Executive Office of the President, and the White House must be viewed as an interacting whole. In addition, the Congress must seriously contemplate taking responsibility for shaping the whole structure in a way which will honor both the freedom and the unique potentialities of the scientific community.—A. HUNTER DUPREE, *Brown University*

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